ARTIFICIAL JOINT

[0001] The invention relates to an artificial joint, especially to replace a human hip joint, comprising a condyle and a joint socket whose associated functional surfaces are functionally interlinked~~, whereby at least one functional surface is spherical in shape and whose cross section has a circular, concave section contour, whereby the orbital radii of each of the associated functional surfaces differ from each other in a main functional plane relative to a secondary functional plane that is rotated by 90° with respect to the main functional plane~~.

BACKGROUND

[0002] Such an artificial condyle for use in a human hip joint is known, for example, from EP 04 63 011 B1. This specification describes an artificial joint consisting of at least two joint parts with spherical functional surfaces that move towards each other. The curvature relationships of the functional surfaces having a circular section contour are convex-convex, convex-concave or concave-concave relative to each other and the joint geometry is determined by a joint chain having two joint axes that run through the rotation centers M1 and M2 of the functional surfaces having the radii R1 and R2. In order to create a pressure-stable joint system and thus to ensure a natural function that is comfortable for humans, a functional element having a specific geometry is located between the two functional surfaces. The parallel or serial arrangement of such a joint is likewise described.

[0003] Moreover, EP 09 69 781 B1 has already described an artificial joint especially for replacing a human hip joint. The artificial condyle is fitted with a spherically shaped joint socket whose cross section has a circular, concave section contour and which has a curvature radius R1 and a curvature midpoint M1. At least in its area that articulates in the joint socket, a spherically convex functional surface is formed in such a way that, when said surface is in the state of having been inserted into the socket, a radius RK1 = R1 with a midpoint MK1 is created in a lengthwise plane X-X running through the

midpoint M1, said midpoint MK1 coinciding with M1. In this manner, a pressure distribution element is not needed and, at the same time, a pressure-stable turned-over dimerous chain is realized that is always the same size when the main functional plane is pivoted.

~~[0004]~~ [0002] Other artificial joints are also known from EP 06 17 595 B, EP 07 34 701 B, EP 06 91 830 B as well as EP 08 31 758 B.

SUMMARY OF THE INVENTION

~~[0005]~~ [0003] ~~Before this backdrop, the invention is based on the objective of improving~~An object of the present invention is to provide an artificial joint that has a condyle and a joint socket and that is intended to replace a human hip joint, in such a way that the load-bearing capacity of the joint as well as the comfort of the patient are considerably improved.

~~[0006] This objective is achieved according to the invention with an artificial joint according to the features of claim 1. The further configuration of the invention can be gleaned from the subordinate claims.~~

~~[0007]~~ [0004] Hence, according to the invention, an artificial joint is provided with which, for purposes of individually adapting the artificial joint to the patient, at least one of the functional surfaces can be affixed in different positions relative to the associated joint socket or condyle. ~~Hence, for the first time, the~~The orbital radii of each of the associated functional surfaces in the main functional plane and in the secondary functional plane that is rotated by 90° with respect to the main functional plane can be optimally aligned with the frontal plane as well as with the sagittal plane of the patient. In particular, interacting forces acting in the frontal plane are not transmitted to the connection between the joint socket and the bone. Rather, the divergent design of the orbital radii of each of the associated functional surfaces allows a deflection movement by means of which the transmission of harmful forces is ruled out.

~~[0008]~~ [0005] Fundamentally, the difference between the orbital radii of the main functional plane and of the secondary functional plane can be achieved by an appropriate design of the first and second functional surfaces. In contrast, it is especially advantageous if a first functional surface displays an asymmetry in the main functional plane as compared to the secondary functional plane while the second functional surface exhibits symmetrical functional planes. In this manner, only one of the two functional surfaces has to have a concave or convex section contour that differs from a spherical shape, as a result of which the production process is facilitated.

~~[0009]~~ [0006] It has proven to be especially advantageous if the first functional surface is associated with the joint socket and the second functional surface is associated with the condyle. As a result, it is avoided that a rotation of the condyle interferes with this deflection movement, thus preventing undesired high stress on the connection between the joint socket and the bone. In particular, this prevents that a rotation of the condyle might be able to shift the functional surface with the smaller orbital radius out of the frontal plane.

~~[0010]~~ [0007] According to an especially advantageous embodiment, the first functional surface is designed so as to be drum-shaped or spindle-shaped or oval, so that the desired joint geometry can be realized in a simple manner.

~~[0011]~~ [0008] After the appertaining joint socket has been affixed to the bone, the functional surface could first be positioned relative to the bone and then affixed permanently in the position thus established by means of an adhesive connection. In contrast, according to an especially practical embodiment, in order to set different positions, the functional surface can be affixed in different locking stages relative to the associated joint socket or to the condyle. This is achieved, for example, by teeth located between the joint socket and the functional surface that allow the fixation of the relative position in 0.5° to 10° increments. This relatively easy adjustability can shorten the duration of the surgery considerably.

~~[0012]~~ [0009] According to another especially advantageous modification, the functional surface can be secured in different positions relative to the associated joint socket or condyle by means of a positive connection. Consequently, the load-bearing capacity of the connection thus created is additionally increased. Moreover, a precise positioning is made possible in this manner.

~~[0013]~~ [0010] The functional surface could be non-detachably locked by being inserted into the joint socket. However, an especially advantageous embodiment of the present invention is one in which the functional surface can be affixed in different positions relative to the associated joint socket or condyle by means of a shrinkage connection. This achieves a non-positive connection that can be positioned with little effort and that is also highly stressable as well as optionally a positive connection that is non-detachable at body temperature.

~~[0014]~~ [0011] An especially practical modification is also achieved in that the diameter of the functional surface of the condyle or of the joint socket in the frontal plane of the patient is to be dimensioned between 0.5 mm and 8 mm, especially 2 mm, greater than the diameter of the functional surface of the condyle or the diameter of the functional surface of the joint socket in the sagittal plane, so that, in this manner, the desired deflection movement in the frontal plane is ensured and, at the same time, the stability of the joint is not considerably reduced. In the sagittal plane, the diameter of the functional surface 5 in comparison to the diameter of the functional surface 4 is to be provided with a play of 0.2 mm to 2 mm. In addition, the functional surface of the condyle can be non-spherical in shape, whereby this functional surface in the sagittal plane has to have the largest radius.

~~[0015]~~ [0012] Suitable materials are fundamentally all materials that are commonly employed in medical technology, whereby especially one embodiment in which the functional surfaces are made of polyethylene allows particularly simple handling.

BRIEF DESCRIPTION OF THE DRAWINGS

~~[0016]—[0013]~~ The invention allows various embodiments. In order to further illustrate their basic principle, one of them is shown in the drawing and is described below. The following is shown:

~~[0017]—[0014]~~ Figure 1 an artificial joint in a frontal section;

~~[0018]—[0015]~~ Figure 2 the artificial joint of Figure 1 in a sagittal section; and

~~[0019]—[0016]~~ Figure 3 the artificial joint shown in Figures 1 and 2 in a cutaway top view.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

~~[0020]—[0017]~~ The fundamental structure of an artificial joint 1 according to the invention, especially one that is intended to replace a human hip joint, is described with reference to Figures 1 and 2, where a cutaway depiction shows the joint 1 in a plane running parallel to the front as well as in a sagittal plane perpendicular thereto. The joint 1 has a spherical condyle 2 and a joint socket 3, consisting of a socket part 3a and an inlay 3b, whose associated functional surfaces 4, 5 are functionally interlinked. The cross section of the inlay 3b of the joint socket 3 has concave section contours, whereby the orbital radii 6, 7 of the functional surface 5 of the inlay 3b differ from each other in a main functional plane relative to the secondary functional plane that is rotated by 90° with respect to the main functional plane. Therefore, this configuration of the orbital radii 6, 7 of the functional surface 5 allows a deflection movement by means of which an acting external force F does not cause damage to the connection between the joint socket 3 and a bone (not shown here).

~~[0021]—[0018]~~ Figure 3 shows the artificial joint 1 depicted in Figures 1 and 2 additionally in a cutaway top view as well as in an enlarged detail view of the joint socket 3 with the socket part 3a and the inlay 3b as well as the condyle 2 including the functional surfaces 4, 5. The diameter DF of the functional surface 5 of the joint socket 3 in the frontal plane is approximately 2 mm greater than the diameter DS in the sagittal plane, thus yielding the additional degree of freedom. In order for the orbital radii 6, 7

determined by the different diameters DF, DS of the functional surface 5 in the main functional plane and in the secondary functional plane to be optimally aligned with the frontal plane as well as with the sagittal plane of the patient, the functional surface 5 can be affixed in different positions relative to the socket part 3a. This is done, for example, by locking stages 8 formed by teeth located between the socket part 3a of the joint socket 3 and the inlay 3b with the functional surface 5, which allows a fixation of the relative position in 1° increments.